him on the arid shores, strewn with striated boulders, of Tempel Bay or Cora Island.

The transport of boulders and striation of rock-floors by ice are, of course, fully admitted, and we have interesting references to Playfair, Perraudin, and de Charpentier. A short account of the origins of sedimentary rocks follows, in which, by a slip, fresh-water shell-limestones become included under "roches argileuses." This part of the book may be regarded as consisting of somewhat scattered notes, all of which have an interest for the professed geologist, but which do not systematically express the growth of geological opinion.

The absence of an index is astonishing. Perhaps the publisher quailed before the proper names, which are very imperfectly corrected in the text. We have Leibniz, Hitchkock and Hitchcok, Mayer-Aymar, Uscher, Revenier, Spalanzani, Moris Davis, d'Aubuisson de Voisin, and Deshays. One or two dates seem erroneous by about a century. G. A. J. C.

LEAD SMELTING.

The Metallurgy of Lead. By H. F. Collins. Edited by Sir W. C. Roberts-Austin, K.C.B., F.R.S. Second edition, thoroughly revised and enlarged. Pp. xx+538. (London: C. Griffin and Co., Ltd., 1910.) Price 21*s.* net.

WE welcome a revised and enlarged edition of this useful work, as the progress ot metallurgy is now so rapid and great improvements have been made in smelting during the last decade. A too brief reference has been made to the physical properties of lead and that of its alloys, and much recent work has been overlooked, probably due to the aim of the author in making the work chiefly a compendium of information on lead smelting, which is here brought well up to date. Ore roasting has received the attention it deserves, and we are glad to find that pot roasting is clearly described, and the chemical reactions occurring in this novel process fully discussed, since a correct knowledge of the chemical changes that occur in any process often leads to advancement and discoveries. Useful data are given as to costs in the various modifications developed from the Huntingdon-Heberlein process.

The most suitable fuel for a given ore is here rightly considered, as well as the proper amount to be used in each case. But the twyer ratio and twyer efficiency are also of great significance, and it is a pity more attention has not been given to the pressure and volume of air supplied to each furnace.

The principles of blast-furnace lead smelting are clearly expressed, as the method of dealing with each constituent, according to its quantity, is essential for economic working. It is also equally important that the proper flux should be applied in order to produce the most suitable slag and to obtain the maximum quantity of metal. This is dealt with in a plain and lucid manner. A comprehensive description of modern furnaces with plentiful illustrations is a good feature in this edition, the parts being described in considerable detail. The important subject of water-jackets receives due attention as more refractory ores have now to be dealt with, necessitating greater height of jacket than formerly. It is shown that with increase of size of furnaces and amount of output larger fore-hearths are required and greater facilities for separating matter and slag. The treatment and disposal of slag are also given due prominence. Formerly the production of matte was considered a necessary evil, but it is now esteemed a desirable thing, since the lead is better reduced and the slag more free from lead and silver.

The various products of lead smelting are amply described, as well as the methods adopted for dealing with them at different works.

In chapter xi. examples of lead smelting in the chief European and American works form the subject of narration, and the following chapter deals with costs and losses.

As all lead ores carry silver and sometimes gold, it often becomes more profitable to work for their extraction than that of the lead itself. The author devotes about 100 pages to a consideration of this important subject. A valuable part of this section is the description of the methods of separating gold from zinc crusts.

In chapter xix. works assaying and analytical methods are dealt with.

In the following chapter the difficult subject of treatment of zinc-lead sulphides is considered, and various methods of separation discussed.

The last chapter deals with flotation processes, which have in recent years assumed great importance.

We consider this work a valuable contribution to the metallurgy of lead, in which so much new matter has been introduced, and it can be confidently recommended as a trustworthy guide to anyone who is interested in the subject.

THE TRISECTION OF AN ANGLE.

The Trisection of the Angle by Plane Geometry: Verified by Trigonometry with Concrete Examples. By Dr. J. Whiteford. Pp. 169. (Greenock: J. McKelire and Sons, Ltd.; Edinburgh and Glasgow: J. Menzies and Co., Ltd.; Cambridge: Bowes and Bowes, 1911.)

THE *Paralogistes pseudomathematicus* has become so rare, or possibly so shy, that it is a real pleasure to find that the species is not extinct. Alack! that De Morgan is not with us, to do justice to this latest attempt at solving one of the three famous problems that have been proved to be beyond the power of Euclidean constructions. The curious thing is that the author, in his introduction, gives two long quotations from De Morgan, in which he states the conditions of the problem with the utmost precision, except that he does not explicitly say that the trisection must be performed by a finite number of operations. It is here that Dr. Whiteford has come to grief, for his method is nothing more or less than successive approximations, each of which involves a Euclidean construction. It is only fair to add that the author is no vulgar paradoxer, and that his method, as an approximation, is sound, and leads o accurate values with a comparatively small number ›f

© 1911 Nature Publishing Group

trials; thus in his examples he works to seven places of decimals, and we have not noticed a case in which more than seven trials are required. The one, unfortunately fatal, objection, is that he has ignored the conditions of the problem; it is as though the value of π were found from the perimeter of a regular polygon of 2^n sides. By taking n large enough, we can get by Euclidean construction a value as near π as we please; but it is needless to say that this is not what is meant by "squaring the circle" with rule and compass.

Dr. Whiteford's method is sufficiently ingenious to deserve a brief description. Let AP be an arc of a circle, of which AOB, COD are perpendicular diameters; then if through P a line PQRS be drawn cutting the circle in R, and the diameters CD, AB in Q, S, so that QS=AB, then the angle ROB is one-third of the angle AOP. This theorem was known to the Greeks, and, in fact, led to the invention of the conchoid of Nicomedes as an auxiliary curve for the trisection of the angle. If we take Q anywhere on CD and produce PQ to S, making QS=AB, the locus of S is a conchoid, and its intersection with AB gives the solution of the problem. Now Dr. Whiteford gives a construction for a point on AB, which is in no case very far from S, and thence obtains a sequence of points which have S for their limiting point. After translating his construction into trigonometry, he gives fifty-one worked-out examples, so variously distributed over the quadrant as to leave no doubt that his sequence does actually converge in every case, though, as might be expected, he makes no attempt to prove this fact.

It is easy to draw the obvious moral that it is waste of time to attack a mathematical problem without completely understanding what the problem is. However, this is perhaps ungracious; let us rather conclude by admitting that Dr. Whiteford has added one more to the fairly numerous approximate solutions of this celebrated problem.

G. B. M.

LILIENTHAL'S WORK ON AVIATION.

Birdflight as the Basis of Aviation: a Contribution towards a System of Aviation, Compiled from the Results of Numerous Experiments made by O. and G. Lilienthal. By Otto Lilienthal. With a biographical introduction and addendum by Gustav Lilienthal. Translated from the second edition by A. W. Isenthal. Pp. xxiv+142+viii plates. (London: Longmans, Green, and Co., 1911.) Price 9*s*. net.

THE interest of this book lies chiefly in the biographical part. The two Lilienthals, born in the town of Anklam, were from childhood devoted to mechanics, and also to natural history. Otto gained practical knowledge as a mechanic in the works of Schuarlzkopf in Berlin, while his brother was educated as an architect. Watching the flight of the storks which abounded about their home seems to have given them their first taste for the problems which afterwards occupied so much of their attention.

One curious passage (p. 103) is here quoted. After a picturesque description of the storks following the harvesters to pick up field mice and such "small deer," and a reference to the high regard in which the birds are held by the farmers, we read:—

> "Thus it is not to be wondered at if the farmers, above whose homesteads these birds with a span of two metres hold great flight meetings every year, evince great interest in the art of flight, though they do not wish it to be known, fearing ridicule. Nevertheless, from no other trade or profession have so many inquiries for light engines—for a secret purpose—reached the author, as from farmers."

The theoretical part of the book is not of any great value, and some of the diagrams (notably those on pp. 45 and 56, of the flow of a stream past an obstacle) are very far from representing the actual facts.

Lilienthal seems to have attached great importance to curved, as against plane, and flapping, as against fixed wings. Flapping wings are really the more efficient of the two, but not for the reasons given.

Difficulties of mechanical construction have hitherto prevented their adequate trial on a large scale, but it would be too much to say that they are impracticable.

The merit of the curved wing section now generally in use is not that it gives an increased lift or efficiency, but that the efficiency does not vary so rapidly with the change of inclination to the air current as happens when the surfaces are planes.

It is seldom that the enthusiasm, mechanical ability, knowledge, and money necessary for experiments in a new field are found in the possession of one and the same individual. Lilienthal had the two first, but was hampered as regards the others. This book, however, which is well translated, should be read as giving a very interesting account of the work of a typical "inventor" of the best class.

A. MALLOCK.

OUR BOOK SHELF.

A Systematic Handbook of Volumetric Analysis; or, the Quantitative Determination of Chemical Substances by Measure, Applied to Liquids, Solids, and Gases. By F. Sutton. Tenth edition. Revised throughout, with numerous additions, by W. L. Sutton and A. E. Johnson. Pp. xiv+621. (London: J. and A. Churchill, 1911.) Price 21*s*. net.

A BOOK that has been the standard text-book on its subject for nearly fifty years, and continues to enjoy that position, calls for little remark as edition after edition is issued. Every student of chemistry knows, or ought to know, his "Sutton," as he knows his "Fresenius," and it would therefore be superfluous to attempt to describe its character and scope. The author, being now eighty years old, has placed the preparation of this tenth edition entirely in the hands of the two editors named in the title. There seems to be every evidence that the editors have done their work thoroughly and judiciously. They say that a good deal of obsolete matter has been deleted, and we naturally turned to some of those classical methods that have served so well in the past, such as Bunsen's method of gas analysis, and have been almost wholly replaced, rather than superseded, by processes that are more suitable for technical work. But the

© 1911 Nature Publishing Group